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Biochar-carrying hydrocarbon decomposers promote degradation during the early stage of bioremediation

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Abstract

© Author(s) 2016. CC Attribution 3.0 License.Oil pollution is one of the most serious current environmental problems. In this study, four strategies of bioremediation of oil-polluted soil were tested in the laboratory over a period of 84 days: (A) aeration and moistening; (B) amendment with 1% biochar (w/w) in combination with A; amendment with 1% biochar with immobilized Pseudomonas aeruginosa (C) or Acinetobacter radioresistens (D) in combination with A. All strategies used resulted in a decrease of the hydrocarbon content, while biochar addition (B, C, D strategies) led to acceleration of decomposition in the beginning. Microbial biomass and respiration rate increased significantly at the start of bioremediation. It was demonstrated that moistening and aeration were the main factors influencing microbial biomass, while implementation of biochar and introduction of microbes were the main factors influencing microbial respiration. All four remediation strategies altered bacterial community structure and phytotoxicity. The Illumina MiSeq method revealed 391 unique operational taxonomic units (OTUs) belonging to 40 bacterial phyla and a domination of Proteobacteria in all investigated soil samples. The lowest alpha diversity was observed in the samples with introduced bacteria on the first day of remediation. Metric multidimensional scaling demonstrated that in the beginning and at the end, microbial community structures were more similar than those on the 28th day of remediation. Strategies A and B decreased phytotoxicity of remediated soil between 2.5 and 3.1 times as compared with untreated soil. C and D strategies led to additional decrease of phytotoxicity between 2.1 and 3.2 times.

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